In the United States Patent and Trademark Office

Before the Board of Patent Appeals and Interferences

Applicant: Stefan Wode

Patent Application
Serial No: 09/986,887

Filed: November 13, 2001

For: Method for Making a Pressure-Tight Attachment of an Elastomeric Tubular Piece to a Connecting Part

Group Art Unit: 3726

Examiner: Stephen Kenny

Attorney Docket: 200-080

Appeal Brief under 37 CFR 1.192

On January 26, 2004, the appellant appealed from the final rejection of claims 1 to 8.

It will be shown below that this rejection is untenable and that the appealed claims patentably distinguish the invention over the combination of references applied thereagainst.

The Commissioner is authorized to charge the required fee of $330.00 as set forth in 37 CFR 1.17(c) as well as any deficiency of payment to Deposit Account No. 15-0773.

Request for Oral Hearing

An oral hearing is requested and the Commissioner is authorized to charge the required fee of $290.00 as set forth in 37 CFR 1.17(d) as well as any deficiency of payment to Deposit Account No. 15-0773.

Real Party of Interest

The real party of interest in this application is the

assignee, Continental Aktiengesellschaft, a corporation organized and existing under the laws of the Federal Republic of Germany and having its principal office at Vahrenwalder Strasse 9, 30165 Hannover, Federal Republic of Germany. The assignee acquired its interest by virtue of an assignment executed by the appellant and recorded by the Assignment Branch of the United States Patent and Trademark Office at reel 012369, frame 0130.

Notwithstanding the assignment, the appellant, Stefan Wode, remains a party of interest because of the German law (Gesetz über Arbeitnehmererfindungen) covering employed inventors.

Related Appeals and Interferences

Appellant's attorney is unaware of any other appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

Status of Claims

Claims 1 to 8 are pending in this application and are the claims appealed herein and are set forth in the Appendix attached hereto.

Status of Amendments

An amendment after final action was filed on December 29, 2003 and was entered as noted by the Examiner in the advisory action mailed on January 16, 2004.

Summary of the Invention

The appellant's invention is directed to a method for making

a pressure-tight attachment of an elastomeric tubular piece to an attachment part. For making the pressure-tight attachment, an open end of a tubular piece made of elastomeric material is pushed onto a connecting part and a metal clamping ring is positioned thereon. While radially pressing the jaws of the clamping device together, the diameter of the clamping ring is reduced and the tubular piece is thereby tightly clamped to the connecting part.

FIG. 1 shows the clamping force K of the clamping device plotted as a function of the diameter (d) between the clamping jaws of the clamping device. This force/displacement characteristic line is detected with the aid of a force sensor and a displacement sensor. The clamping jaws first pass through an air gap and only the more or less constant sliding friction is to be overcome (not shown). When the clamping jaws come into contact with the clamping ring (d1), the force/displacement curve climbs in correspondence to the hardness of the clamping ring and the clamping ring reduces in diameter from d1 to d2. The clamping ring is elastically deformed. With a further pressing together of the clamping jaws (d2 to d3), a plastic deformation of the clamping ring takes place. The force, which is to be developed at this stage of the pressing operation, is given by the sum of the inner friction of the press tool (dependent upon the position of the force sensor) and the force, which is needed for the plastic deformation of the clamping ring, which is substantially constant.

Driving the clamping jaws farther together leads to a further plastic deformation of the clamping ring and to a force

between the tubular resilient member and the connecting part (cover or roll-off piston). A deformation of the connecting part also takes place here which can be seen from an increase of the force/displacement curve (starting at d3). In this range, the increase of the force/displacement curve is substantially dependent upon the stiffness of the connecting part.

According to the invention, this straight-line ascending region is exceeded and reaches a maximum of the force whereafter the force, which is to be developed, again slightly drops. The maximum of the curve is only evaluated when an additional criterion ($K > K_{min}$ or $d < d3$) is satisfied; that is, another local maximum (for example at d1) should not be evaluated. This local maximum is dependent upon the type of machine used or the location of the force sensor. According to the invention, a ΔK is postulated as a switchoff criterion; that is, if the force drops by ΔK, then the clamping operation is ended. A further continuation of the clamping operation would result in a destruction of the clamping part at point X.

With the invention, the clamping of the end of the tubular piece to a connecting part by a plastically deformable clamping ring is terminated at the correct time, that is, before damage occurs but only when a sufficient strength is ensured.

For example, a thin walled material can be used for the production of air springs. Furthermore, parts having high tolerances with respect to hardness and thickness can nonetheless be reliably clamped. A material-specific optimization of the clamping connection is also possible without knowledge of the individual material characteristics.

Issue

This appeal brief is directed to the issue presented in the Examiner's final action responding to the appellant's arguments in the amendment filed on July 9, 2003 in response to the first action. The Examiner's comments in the advisory action mailed on January 16, 2004 are also considered.

Issue - Whether claims 1 to 8 are patentable under 35 USC §103(a) over European patent publication 0 548 627 (Schlei et al) in view of United States Patent Re. 33,714 (Anderson et al).

Arguments

Issue - Whether claims 1 to 8 are patentable over the combination of Schlei et al and Anderson et al.

The following will show that claim 1 patentably distinguishes the invention over this combination of references.

Schlei et al is directed to a method and an arrangement for pressure-tight attaching a tubular piece to a connecting part wherein the axial force is measured. It is this axial force which is used as a switch-off criterion for the clamping operation.

This is set forth in Schlei et al at column 3, line 56, and continuing to column 4, line 6, which is translated below:

> "In this radial tensioning, an axially directed force develops at connecting part 22 which is measured as a pressure force by pressure-measuring element 14. The proportional electric output signal of the pressure-measuring element 14 is interpreted in the evaluation unit and effects a switchoff of the hydraulic drive, which charges the clamping segment 31, when

a predetermined limit value is reached."
(emphasis added)

Thus, from the above, it can be seen that it is indeed the axial force which is measured in Schlei et al.

In contrast to Schlei et al, it is not the axial force which is detected in the appellant's method but the radial clamping force as set forth in appellant's claim 1 with the clause:

> "detecting the <u>radial</u> clamping force developed during the clamping operation between said clamping ring and said tubular piece;" (emphasis added)

In addition and in further contrast to Schlei et al, a force/displacement curve is measured during the clamping operation and a characteristic feature thereof is used as a basis for a criterion for switching off the application of the clamping force. These features too are also set forth in claim 1 with the clauses:

> "observing and measuring a force/displacement curve during said clamping operation; and,
>
> utilizing a <u>characteristic feature of said force/displacement curve as a basis for a criterion for switching off the application of said clamping force</u>." (emphasis added)

These measurement quantities of radial force (K) and displacement (d) are shown in the measuring curve of FIG. 1 of the appellant's drawing.

In view of the above, it can be seen that an entirely different force is determined and evaluated. Schlei et al provide no suggestion as to the determination of this clamping force, let alone, for measuring a force/displacement curve during

the clamping operation and <u>utilizing a characteristic feature thereof as a criterion</u> for switching off the application of the clamping force.

There is no suggestion in Schlei et al which would enable our person of ordinary skill to hit upon the idea of utilizing a radial clamping force in combination with a measured force/displacement curve as set forth in appellant's claim 1.

Stated otherwise, not only does Schlei et al not send our person of ordinary skill in the correct direction, that is, to measure radial force, Schlei et al also does not provide our artisan with any clue as to how the last three method steps of claim 1 could possibly be arrived at.

In view of the above, how could our artisan possibly want to rely on Anderson et al to fill the huge void left by Schlei et al?

Anderson et al is directed to a crimping tool which is very different from a tool having clamping jaws for applying a clamping force to a clamping ring for attaching a tubular member made of elastic material. The crimping force is really a pinching operation as can best be seen by referring to FIG. 1 of this reference which shows the two jaws 20 and 42. Crimping tools are used, for example, to attach terminals to wire ends and joining wires using deformable connectors.

On page 2, last paragraph, of the final action, the Examiner describes Anderson et al as disclosing the performance of a crimping operation:

> "wherein the <u>radial</u>/crimping force is measured (column 1, lines 54-60)."
> (emphasis added)

There is no discussion of a radial force in Anderson et al, let alone, a measurement of this force. A radial force is, by definition, a force which is directed to a center. In Anderson et al, two jaws (20, 42) shown in FIG. 3 of this reference are brought together for crimping a terminal or the like. Thus, the two jaws (20, 42) are parallel to each other and brought together in the manner of a vice so that there can be no suggestion in this reference of a radial force as in the applicant's invention.

In addition, there is no method step of measuring a force in Anderson et al as suggested by the Examiner on page 2, last paragraph, of the advisory action and no step of observing and measuring a force/displacement curve during the clamping operation. What Anderson et al does show is a detent mechanism which indicates to the user of the crimping tool when a predetermined force is exceeded. Thus, the user is given a tactile and audible indication when the manual force applied to the handles 12 has exceeded a predetermined force. This force is set utilizing the adjusting screw 114 as noted in column 7, lines 7 to 9, of Anderson et al, where it is stated that:

> "It should be apparent that the force to be sensed (by the user) is set by a suitable compression of the compression spring by the adjustment screw 114." (parenthetical material added)

Accordingly, the crimping tool is far afield from a method for force-tightly attaching a tubular piece made of elastomeric material to a connecting part.

From the above, it is evident that there is really no thread which ties Schlei et al and Anderson et al together so that our

artisan would not consider these references in combination. Accordingly, it is not seen how our person of ordinary skill would be encouraged to attempt to supplement the teaching of Schlei et al with the teaching of Anderson et al to arrive at the appellant's invention.

Appellant emphasizes that nowhere in either reference is there any suggestion of measuring radial force nor of observing and measuring a force/displacement curve, much less, utilizing a feature of this curve as a criterion for switching off the application of the clamping force.

In view of the above, applicant respectfully submits that claim 1 patentably distinguishes his invention over the combination of Schlei et al and Anderson et al so that this claim should be allowable.

Claims 2 to 8 are dependent directly or indirectly from claim 1 so that these claims too should be allowable.

Conclusion

The appellant has shown that our person of ordinary skill could not arrive at the appellant's invention from a study of Schlei et al in combination with Anderson et al.

There is no suggestion in the applied references which would enable our artisan to come upon the idea of detecting a radial clamping force and observing and measuring a force/displacement curve during the clamping operation and then utilizing a characteristic feature of this curve as a criterion for switching off the application of the clamping force.

For the reasons advanced above, appellant submits that the

Examiner's final rejection of the pending claims 1 to 8 is erroneous and respectfully requests that his decision be reversed.

Respectfully submitted,

Walter Ottesen

Walter Ottesen
Reg. No. 25,544

Walter Ottesen
Patent Attorney
P.O. Box 4026
Gaithersburg, Maryland 20885-4026

Phone: (301) 869-8950

Date: March 26, 2004

Appendix

The appealed claims are claims 1 to 8 of which claim 1 is in independent form.

1. A method for force-tightly attaching a tubular piece made of elastomeric material to a connecting part, the method comprising the steps of:

pushing an open end of said tubular piece onto said connecting part so that a pushed on end region of said tubular piece is on said connecting part;

positioning a metal clamping ring around said tubular piece at the pushed on end region thereof;

radially applying a clamping force (K) during a clamping operation to said clamping ring to reduce the diameter of said clamping ring and thereby tightly clamping said tubular piece on said connecting part;

detecting the radial clamping force developed during the clamping operation between said clamping ring and said tubular piece;

observing and measuring a force/displacement curve during said clamping operation; and,

utilizing a characteristic feature of said force/displacement curve as a basis for a criterion for switching off the application of said clamping force.

2. The method of claim 1, wherein said tubular piece is a resilient member of an air spring and said connecting part is a cover or a piston of an air spring.

3. The method of claim 1, comprising the further step of ending

said clamping operation only when said clamping force begins to drop for the first time after a defined maximum of said curve has been exceeded.

4. The method of claim 1, wherein said clamping force is radially applied to said clamping ring with clamping jaws having a diameter (d) therebetween corresponding to said diameter of said clamping ring; said force/displacement curve is a plot of said clamping force (K) as a function of said diameter (d) measured along an abscissa; said force/displacement curve includes a segment during which a plastic deformation of said clamping ring takes place as said diameter (d) is reduced from a diameter (d2) to a diameter (d3) and, after said diameter (d3), said clamping force (K) is increased and causes a deformation also of said connecting part as said diameter (d) is further reduced beyond said diameter (d3) whereupon a maximum value of said clamping force (K) greater than a value K_{min} thereof is reached corresponding to a maximum of said curve; and, the maximum of said curve is only used for evaluation when $K > K_{min}$ and/or $d < d3$ is satisfied as an additional criterion.

5. The method of claim 4, wherein said maximum of said curve defines a turning point whereat the shape of said curve changes from positive slope to negative slope; and, said turning point of said force/displacement curve is used as a switchoff criterion so that said application of said clamping force is switched off after said clamping force falls off from said maximum by a predetermined increment (ΔK).

6. The method of claim 1, comprising the further step of, after the clamping operation, making a determination as to whether the

obtained parameter (force/displacement) lies within a defined tolerance band.

7. The method of claim 1, comprising the further step of using a plastic deformable material for said connecting part having a failure elongation which is not exceeded while performing the steps of the method.

8. The method of claim 1, wherein said clamping force is radially applied to said clamping ring with clamping jaws having a diameter (d) therebetween corresponding to said diameter of said clamping ring; and, said force/displacement curve is a plot of said clamping force (K) as a function of said diameter (d) measured along an abscissa.